SUPPORTING DOCUMENT NO. 8
Item 5

Project Summary

Demonstration
of
An Advanced Storm Water Runoff Treatment System
At
The Navy Regional Recycling Center, San Diego

Goals The goals are to demonstrate to the California Regional Water Quality Control Board - San Diego District that the Navy developed filtration-adsorption technology (1) can substitute for termination of the first ¼ inch, (2) will pass bioassay tests, and (3) will reduce copper and zinc discharges to below permitted limits. We will demonstrate to the Navy that the technology (1) will allow the Navy to meet all CRWQCB requirements, (2) is low cost and easy to install, (3) requires little land area, and (4) is inexpensive to maintain.

Background Metals in storm water runoff water from Navy industrial sites are a significant problem. In many instances, the concentrations of metals routinely exceed the discharge permit limits. In San Diego, CRWQCB Order R9-2002-0169 requires the Navy to (1) terminate the first ¼ inch of runoff, (2) pass a 96-hour bioassay test, and (3) reduce the concentration of copper in runoff from certain *high risk* areas to less than 63 μg/L and reduce the concentration of zinc to less than 117 μg/L.

RDT&E Effort A research and development effort at the Naval Facilities Engineering Service Center has identified several industrial commodities that remove copper, zinc, lead, cadmium, and other metals to very low concentrations. The process used is called adsorption. Adsorption is the adhesion of ions or molecules to the surface of a material by electrical forces. Storm water is processed by flowing runoff through a bed of filter-adsorption media.

A model of the planned treatment system was tested at the NRRC San Diego in 2004. Figure 1 shows the construction of a $1/20^{th}$ scale model of the planned storm water treatment system. The model is 6.5 ft. wide by 4.0 ft. deep by 2.0 ft long. Figure 2 shows a transportable test stand with the scale model installed.

The filter-adsorption bed was a layer of sand and gravel over a layer of bone char over a layer of iron coated activated alumina. The sand and gravel layer is a coarse filter. The bone char and activated alumina remove metals both by straining and adsorption. Performance data was collected on the effectiveness of the filter-adsorbent bed and the toxicity of the effluent. Engineering data was collected on parameters such as flow capacity, particle settling in the pretreatment chamber, and pressure loss across the filter bed.

Figure 1 Scale Model of Planned Storm Water Treatment System

Figure 2 Scale Model Installed on Test Stand

Typical experimental results using the new adsorption media and storm water runoff from the Navy Regional Recycling Center are presented in Tables 1 through 4

Table 1 Metals Removal Effectiveness Results - Test Number 1

Parameter	Method	Influent	Effluent	Units	Limit
Aluminum	EPA 200.7	1400	84	µg/L	750
Cadmium	EPA 200.7	39	ND	µg/L	15.9
Chromium	EPA 200.7	6	ND	µg/L	20
Copper	EPA 200.7	994	62	µg/L	64
Iron	EPA 200.7	1920	125	µg/L	1000
Lead	EPA 200.7	182	5	µg/L	82
Zinc	EPA 200.7	1620	66	µg/L	117

Table 2 Metals Removal Effectiveness Results - Test Number 2

Parameter	Method	Average Influent	Average Effluent	Units	Limit
Aluminum	EPA 200.7	695	87	µg/L	750
Cadmium	EPA 200.7	33	ND	µg/L	15.9
Chromium	EPA 200.7	0	ND	µg/L	20
Copper	EPA 200.7	938	56	µg/L	64
Iron	EPA 200.7	1950	136	µg/L	1000
Lead	EPA 200.7	101	5	µg/L	82
Zinc	EPA 200.7	2100	69	µg/L	117

The 96-hour acute toxicity test results are presented in Tables 1 and 2. The test organism was *mysidopsis bahia.*

Table 3 Acute Toxicity Test Results – Test Number 1

% effluent	% Survival
100	97.5
50	100
25	100
12.5	100
6.25	100
control	100

Table 4 Acute Toxicity Test Results – Test Number 2

% effluent	% Survival
100	100
50	100
25	97.5
12.5	97.5
6.25	100
control	100

Figure 3 Photo of Influent and Effluent from Treatment System

Full Scale Demonstration Effort Based on the results of laboratory and field tests, funding was obtained from the Environmental Security Technology Certification Program (ESTCP) for a large-scale demonstration of filter-adsorption technology. The ESTCP is a DoD level program to validate the technical and economic performance of processes that prevent pollution, ensure compliance with regulations, or improve site cleanup capabilities.

It is planned to demonstrate a full-scale storm water runoff treatment system at the Navy Regional Recycling Center San Diego. The installation will consist of a below grade filter-adsorption system approximately 50 feet in length, 7 feet in width, and 4 feet in depth. The system is designed to treat the runoff from over 90% of all rain events.

A sketch of the cross section of the filter-adsorption treatment system is shown in Figure 4

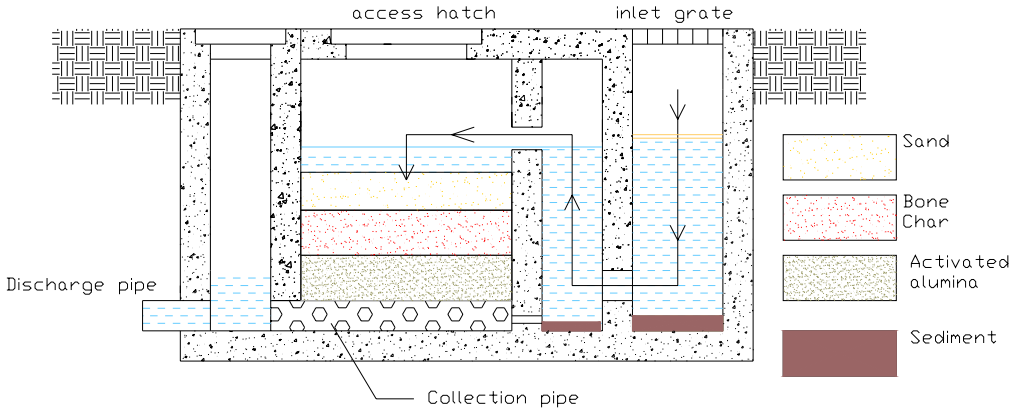

Figure 4 Cross Section of Storm Water Runoff Treatment System

Site Characteristics The location of the planned demonstration is shown in Figure 5 as a yellow bar.

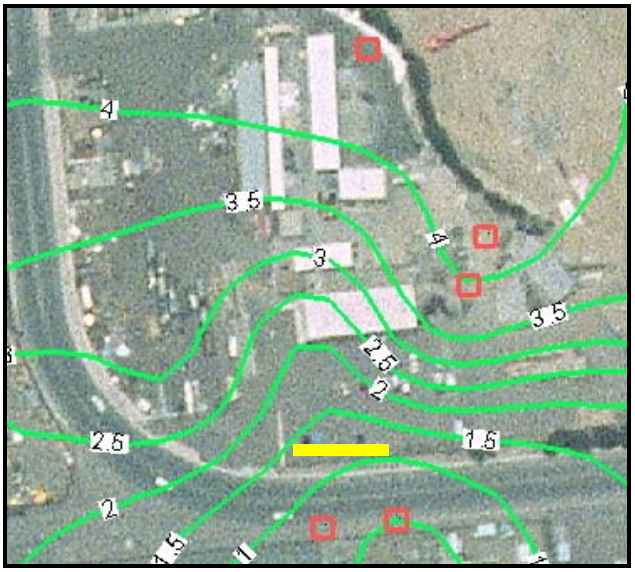

Figure 5 Location of Planned Demonstration

The planned installation will treat storm water runoff from approximately 3.25 impervious acres.

A histogram of historical rainfall data for San Diego is presented in Figure 6. Figure 6 shows that over 90% of the rain occurs as storms of 0.5 inches or less. The average storm duration is 3 hours. Site characteristics and rainfall data were input into the EPA Storm Water Management Model computer code. The results from the computer simulation predict a peak runoff rate of 0.56 cubic feet per second (250 gallons per minute) and a total runoff volume of 5600 cubic feet (41,900 gallons).

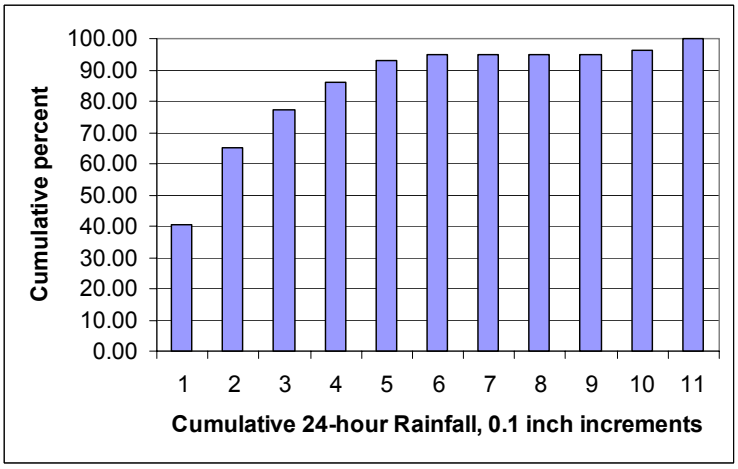

Figure 6 Rainfall Histogram

The planned demonstration installation is designed to treat this rate and volume.

The water quality volume for this site that is required by the Naval Station permit to be "terminated" is:

Water quality volume = 3.25 (acres)* 43560 (sq. ft/acre) * (1/4 inch of rain)/12 (in./ft.) * 7.48052 (gallons/cu.ft.) = 22,062.86 gallons.

The treatment system will remove the pollutants from the first ¼" of runoff plus the remove the pollutants from an additional ¼" of runoff. Therefore, the planned treatment system will prevent twice as much pollutants from entering the receiving waters as "termination" will remove.